This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School

for Boys and Girls — Loueizeh - Baabda

Stage Exam 06

19, 20, 21JUN2023

Do NOT write in this box. Your MARK will be placed here.

Subject :	Chemistry
Class :	9B and 9C
Teacher :	Mrs. Mirella Freige
Duration :	1 hour

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

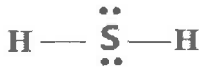
- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Exercise 1 (7 points) Ionic Compounds and Molecular Compounds

In nature, ionic compounds are solids. They are characterized by their rigid structure. They have higher boiling and melting point temperatures than those of molecular compounds. This is due to the strong electrostatic force of attraction between the ions in ionic compound.
The table below represents the boiling and the melting point temperatures for some ionic and molecular compounds at a given pressure.

Compound	Melting point temperature(°C)	Boiling point temperature(°C)
Methane	-182	-161
Sodium chloride	801	1413
Water	0	100
Magnesium oxide	2852	3600

The Lewis electron dot structure of hydrogen sulfide molecule H_2S is given as:



1. Refer to the above table and text:
1.1. Pick out the reason why ionic compounds have high melting points.
1.2. List the ionic compounds.

2. Refer to the Lewis electron dot structure of hydrogen sulfide molecule:
2.1. Indicate the type of bond between the sulfur atom and each of the hydrogen atoms in H_2S molecule. Justify.
2.2. Verify that the element sulfur belongs to group VI (column 16) in the periodic table.

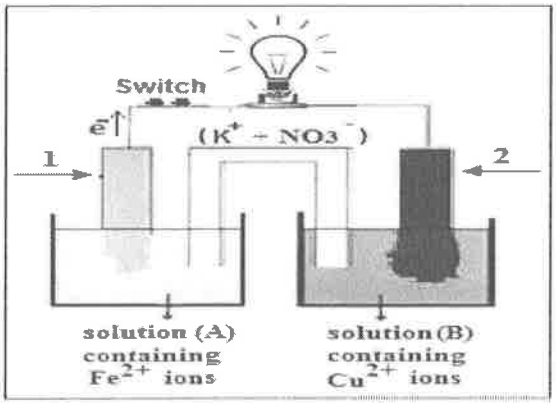
3. The electron configuration of potassium atom is: $K^2\ L^8\ M^8\ N^1$. Potassium reacts with sulfur to produce the compound potassium sulfide K_2S.
- Explain the bond formation in the compound potassium sulfide.

4. The boiling point temperature of the compound hydrogen sulfide is (- 66°C).
- Choose, among the propositions given below, the one that corresponds to the boiling point temperature t of potassium sulfide:

a- t equals to (- 66°C) **b**- t less than (- 66°C) **c**- t greater than (- 66°C)

Exercise 2 (7 points) Functioning of Galvanic Cell

A galvanic cell is a device that converts chemical energy into electrical energy due to a spontaneous redox reaction. The below schema represents a functioning galvanic cell.



1. Label the numbered parts 1 and 2 of the galvanic cell.

2. Indicate the anode of the above galvanic cell. Justify.

3. Write the half-equation of the reaction that takes place at the anode.

4. The equation of the overall redox reaction of the functioning galvanic cell is:

$$Fe + Cu^{2+} \rightarrow Fe^{2+} + Cu$$

Deduce the half-equation of the reaction that takes place at the cathode.

5. During the functioning of this cell, the quantity of Fe^{2+} ions varies in solution **(A)**.

5.1. Compare the amount of Fe^{2+} ions in solution **(A)** before and after the functioning of the galvanic cell.

5.2. Specify the ions that migrate from the salt bridge toward solution **(A)** to maintain its electroneutrality.

Exercise 3 (6 points) Hydrogen Chloride

Hydrogen chloride (HCl) is a colorless gas of strong odor. An aqueous solution of this gas is called hydrochloric acid.
Hydrochloric acid is present in the gastric juice of humans. Excessive secretion of this acid causes gastric ulcers. A marked deficiency of this acid impairs the digestive process and is sometimes the primary cause of deficiency anemia. **Document-1** shows the position of each of hydrogen and chlorine elements in the periodic table.

1- Pick out from the text, the consequences of a marked deficiency of hydrochloric acid in the gastric juice.

2- Referring to **Document-1**, answer the following questions:

Element	Column(group)	Row(period)
Hydrogen	1 (I)	1
Chlorine	17 (VII)	3

Document-1

2.1- Give the number of valence electrons of hydrogen.

2.2- Choose, among the following, the electron configuration of chlorine element. Justify.
a) $K^2 L^7$ b) $K^2 L^{10} M^7$ c) $K^2 L^8 M^7$ d) $K^2 M^8 L^7$

3- Hydrogen chloride (HCl) is a compound constituted of the elements hydrogen (H) and chlorine (Cl).
- Explain the bond formation in the hydrogen chloride molecule.

4- Chlorine gas Cl_2 and hydrogen gas H_2 are prepared according to the following half equations:

$$2Cl^- \rightarrow Cl_{2(g)} + 2\bar{e} \qquad (E_1)$$
$$2H^+ + 2\bar{e} \rightarrow H_{2(g)} \qquad (E_2)$$

- Show that Cl^- ion is a reductant and H^+ ion is an oxidant.

SE06/20222023/Chemistry/9BC

Exercise 1

1.1. This is due to the strong electrostatic force of attraction between the ions in ionic compound. (0,5)

1.2. Sodium chloride and Magnesium oxide. (0,5)

2.2.1. Between the sulfur atom and each of the Hydrogen atom: single covalent bond since Sulfur shares with each of the H atom 1 pair of electrons. (1½)

2.2. Group: number of valence electrons
S has shared 2 $\bar{e}$ pairs = it has 2 single $\bar{e}$ and has 2 non bonding $\bar{e}$ pairs (1 non bonding $\bar{e}$ pair = 2 $\bar{e}$)
S: has: 2 + 2 + 2 = 6 valence $\bar{e}$
S belongs to G VI (col. 16). (1½)

3. K: $K^2L^8M^8N^1$
K: to become stable and satisfy the octet rule K loses 1 $\bar{e}$ and gives K^+ ion. according to:

$$K \longrightarrow 1\bar{e} + K^+$$ (0.5)

S: G VI, to become stable and satisfy the octet rule, S gains 2 $\bar{e}$ (lost by 2 potassium atoms) and gives S^{2-} according to:

$$S + 2\bar{e} \longrightarrow S^{2-}$$ (0.5)

K^+ and S^{2-} ions are oppositely charged, they attract each other by electrostatic force to form the stable ionic compound Potassium sulfide K_2S (1½)
(To verify the electroneutrality, 2 potassium atoms and one sulfur atom are needed).

4. the boiling point temperature t of potassium sulfide K_2S is c. t greater than (−66°C). (0.5)

Exercise 2 Functioning of Galvanic Cell:

1. 1: Iron blade (Fe(s)) (1)
   2: Copper blade (Cu(s)). (1)

2. The anode is Fe blade since it loses $\bar{e}$. ($\bar{e}$ move from the anode to the cathode) (1)

3. Anode: $Fe \longrightarrow 2\bar{e} + Fe^{2+}$. (1)

4. Cathode: $Cu^{2+} + 2\bar{e} \longrightarrow Cu$. (1)

5. 5.1. During the functioning of the galvanic cell, the amount of Fe^{2+} ions increases. (Fe is transformed into Fe^{2+} ions = There is formation of Fe^{2+} ions) (1)
   5.2. NO_3^- ions migrate towards solution (A) to maintain its electroneutrality. (1)

Exercise 3: Hydrogen Chloride

1. A marked deficiency of hydrochloric acid in the gastric juice impairs the digestive process and is Sometimes the primary cause of deficiency anemia. (0.5)

2. 2.1. Doc. 1: H: GI (col. 1); H has 1 valence electron (0.25)
   2.2. Electron conf. of Cl (G VII, Row 3): it has 3 occupied Shells (K, L and M): K is satured with $2\bar{e}$ (0.25)
   L " " " $8\bar{e}$ (0.25)
   and it has 7 valence $\bar{e}$.

Electron Configuration of Cl is c) $K^2L^8M^7$ (0.25)

3- H : GI ; to become stable and satisfy the duet rule, Hydrogen needs one electron. (0.75)
Cl : G VII ; to become stable and satisfy the octet rule, chlorine needs one electron. (0.75)
Hydrogen and chlorine atoms share one pair of electrons and a single covalent bond is formed (1)

4- (E_1) $2Cl^- \longrightarrow Cl_{2(g)} + 2\bar{e}$; (E_2): $2H^+ + 2\bar{e} \rightarrow H_{2(g)}$

$(E_2)H^+$: oxidant, since it gains $2\bar{e}$ and undergoes a reduction. (1)

(E_1): Cl^-: Reductant, since it loses electrons and undergoes an oxidation. (1)